Publicly Acceptable

There may be some unhappiness on the part of the public for having to pay a higher price for their water heater under the command and control implementation approach. Under a market-based approach, where any cost difference could be offset by rebates from the purchase of emission credits, there may be more public support.

Politically Acceptable

No issues were identified other than those described above.

Consensual

N/A.

Voluntary

N/A.

Who Pays - Fairness

The control measure is designed to cover all residential gas-fired water heaters in the source category, so the costs are spread evenly among all sources.

Location

The requirement applies to all gas-fired sources in the five county region.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Since part of the low-NO_x design is often to incorporate better fuel economy (e.g., through better insulation), fewer of the other products of combustion (i.e., besides NO_x, such as CO, VOC, and some HAPs) would be emitted.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

To the extent that the new equipment is designed to be more energy efficient, less fuel will be consumed.

Secondary Costs

None identified.

MEASURE NO. 27
SOURCE CATEGORY Residential Space Heaters
CONTROL MEASURE Low NO_x Burners

DESCRIPTION

This control measure is analogous to control measure #26. However, many air pollution agencies have yet to require the same controls on space heaters as on water heaters. Presumably, this is due to the temporal pattern of emissions from this source category (i.e., Fall and Winter season) versus water heaters (all year around). Since ozone season is during the summer, ozone reduction benefits associated with controlling space heater emissions would be minimal at best. Therefore, it is recommended that this control measure be dropped from consideration. If this control measure is not dropped from consideration, similar costs and emission reductions are assumed for this control measure as for measure #26. No information was identified specifically for space heaters other than information contained in SCAQMD Rule 1111 (SCAQMD, 1993).

27. Residential Space Heaters: Require the Installation of Low NO_x Heaters for All New/Retrofit Applications

COST
Capital Cost Not available. Operating and Maintenance Cost Not available. Annualized Direct Costs Not available. Administrative Costs/Issues No administrative costs were available. Although, if a control measure were established, then an additional administrative burden would be placed on the air pollution control agencies in order to review and process compliance forms.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels Assumed to be the same as control measure #26. Applicability - how many sources, their size This control measure would apply to all gas-fired residential space heater owners and new equipment installers in the five county region.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

In 2005, if this control measure were established, an unknown but very small amount of NO_x would be reduced during the summer ozone season. Estimates of emission reductions for the overall residential combustion category are given under Control Measure #26.

Permanence

Emission reductions are permanent.

Measurable

Emission reductions could be tracked via sales data for new equipment.

Availability

No availability issues.

COST-EFFECTIVENESS - Not available. The cost effectiveness is expected to be very low, since equipment meeting these limits has been available since the mid-1980's.

IMPLEMENTABILITY

Enforcement

As with Control Measure #26, enforcement would be implemented through periodic inspection of distributors, retailers, or installers.

Ease of Determining Compliance

Manufacturer's would be required to include the model number and certification status on both the shipping carton and equipment rating plate.

Implementation Ease

Since the equipment is commercially-available, the main issue would be to allow adequate lead time for equipment vendors/installers to deplete/return their stock of non-compliant heaters.

The rule could also be implemented through a market-based approach (SCAQMD, 1994). Under this approach, new equipment meeting the emission standards would be eligible for emission credits.

Timing of Reductions

If the requirement were to be put in place by 1998, then 1999 would be the year to apply reductions. However, these would be annual reductions. The summer daily reductions would be essentially zero (since space heaters are not used during the summer).

Publicly Acceptable

There may be some unhappiness on the part of the public for having to pay a higher price for their space heater. A market-based approach of establishing emission reduction credits would allow for offsetting the higher costs, if any.

Politically Acceptable

No issues were identified.

Consensual

N/A.

Voluntary

N/A.

Who Pays - Fairness

The control measure is designed to cover all gas-fired space heaters in the source category, so the costs are spread evenly among all sources.

Location

The requirement applies to all gas-fired space heaters in the five county region.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Since part of the low-NO_x design may be to incorporate better fuel economy, fewer of the other products of combustion (i.e., besides NO_x, such as CO, VOC, and some HAPs) would be emitted. However, as stated above, these reductions would occur during non-Summer months.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

None identified.

Secondary Costs

None identified.

MEASURE NO. 28
SOURCE CATEGORY Medical Waste Incinerators
CONTROL MEASURE Selective Non-Catalytic Reduction

DESCRIPTION

This control measure requires the use of add-on controls for all medical waste incinerators (MWIs) to control NO_x. The measure would require that the add-on control achieve a control efficiency equivalent to SNCR which is estimated to be 45% (Pechan, 1994b). The control efficiency and costs are estimated from SNCR applications on municipal waste combustors [MWCs (see Control Measure #29)].

28. Medical Waste Incinerators: Require Application of Add-On Controls Equivalent to SNCR
COST
Capital Cost Not available. Operating and Maintenance Cost Not available. Annualized Direct Costs Not available. Administrative Costs/Issues Administrative costs will be incurred by both the air pollution agency and source if reporting and recordkeeping requirements are included in the rule. Reporting and recordkeeping requirements are recommended to assure compliance with the rule.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels Assumed to be the same as MWCs (see control measure #26), which have demonstrated 45% control efficiency using SNCR (Pechan, 1994b). Applicability - how many sources, their size This control measure would apply to all new and existing MWIs in the five county region. Emission Reductions by Pollutant-estimated reductions - VOC only, NO_x only, VOC and NO_x combined In 2005, 0.007 tpd of NO_x would be reduced.

Permanence

Emission reductions are permanent.

Measurable

Emission reductions could be tracked via source reporting and recordkeeping requirements. The control measure could also require the use of continuous emissions monitoring (CEM) equipment and subsequent submittal of CEM data with the compliance reports. Costs for CEM requirements have not been included in the cost data presented here.

Availability

No availability issues.

COST-EFFECTIVENESS - Estimated to be $12,000/ton (Pechan, 1994). Estimated to be three to four times the cost of SNCR applications on MWCs, which are much larger units (the average size for an MWC is 600 Mg/day versus 3 Mg/day for an MWI).

IMPLEMENTABILITY

Enforcement

Enforcement would be implemented through reporting requirements and/or periodic inspections (especially if CEM are not required).

Ease of Determining Compliance

Compliance would be determined via review of source compliance reports.

Implementation Ease

No issues were identified.

Timing of Reductions

If the control measure was adopted by 1998, then 1999 would be the year to apply reductions, assuming the source is allowed one year to achieve compliance.

Publicly Acceptable

No issues were identified.

Politically Acceptable

No issues were identified.

Consensual

N/A.

Voluntary

N/A.

Who Pays - Fairness

The control measure is designed to cover all MWIs, so the costs are spread evenly among all sources.

Location

The requirement applies to all MWIs in the five county region.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Ammonia slip emissions from the SNCR control will increase $PM_{2.5}$ emissions from the source, since the ammonia will combine with sulfate and nitrate either in the stack or ambient air to form a particulate ammonium salt. The control will also require a small amount of electricity to drive compressors and other electrical equipment which can be associated with emissions of various criteria pollutants, GHGs, and HAPs from the power generation source.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

None identified.

Secondary Costs

Consumption of reducing reagent (e.g., ammonia or urea) and the energy associated with producing these chemicals.

MEASURE NO. 29
SOURCE CATEGORY Municipal Waste Incinerators
CONTROL MEASURE Selective Non-Catalytic Reduction

DESCRIPTION

This control measure requires the use of add-on controls for small MWCs (>35 Mg/day and <225 Mg/day). The MACT standard for MWCs included a requirement for control of NO_x emissions to 190 ppmv (equivalent to SNCR control) for large existing facilities [>225 Mg/day (Pechan, 1994b)]. EPA decided not to set limits for small facilities. EPA estimated that the standard would affect 73% of the existing national capacity. For the purposes of this analysis, it is assumed that the source distribution within the five county area is the same as the national distribution, so that the proposed rule would affect 27% of the source category. Better estimates of costs and emission reductions could be made with information of the capacity by source within the inventory.

29. Municipal Waste Combustors: Require Application of Add-On Controls Equivalent to SNCR on Small MWCs
COST
Capital Cost Not available. Operating and Maintenance Cost Not available. Annualized Direct Costs Not available. Administrative Costs/Issues Administrative costs will be incurred by both the air pollution agency and source if reporting and recordkeeping requirements are included in the rule. Reporting and recordkeeping requirements are recommended to assure compliance with the rule.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels Assumed to be the same as larger MWCs covered by the MACT standard - 45% (Pechan, 1994b). Applicability - how many sources, their size This control measure would apply to all small MWCs (>35Mg/day and <225 <Mg/day) in the five county region. No data were available to determine the number of sources that would fall within this size range.

Emission Reductions by Pollutant-estimated reductions - VOC only, NO_x only, VOC and NO_x combined

In 2005, 0.1 tpd of NO_x would be reduced.

Permanence

Emission reductions are permanent.

Measurable

Emission reductions could be tracked via source reporting and recordkeeping requirements. The control measure could also require the use of continuous emissions monitoring (CEM) equipment and subsequent submittal of CEM data with the compliance reports. Costs for CEM requirements have not been included in the cost data presented here.

Availability

No availability issues.

COST-EFFECTIVENESS - Estimated to be $2,700/ton for the large sources covered by the MACT standard (Pechan, 1994b). For this assessment, it is assumed that the cost effectiveness for small MWCs will be as much as twice that of the larger facilities. Therefore a range of $2,700 to $5,400/ton is estimated.

IMPLEMENTABILITY

Enforcement

Enforcement would be implemented through reporting requirements and/or periodic inspections (especially if CEM are not required).

Ease of Determining Compliance

Compliance would be determined via review of source compliance reports.

Implementation Ease

No issues were identified.

Timing of Reductions

If the control measure was adopted by 1998, then 1999 would be the year to apply reductions, assuming the source is allowed one year to achieve compliance.

Publicly Acceptable

No issues were identified.

Politically Acceptable

Since EPA opted not to regulate these sources, establishment of control standards for the small MWCs will likely involve some political difficulties.

Consensual

N/A.

Voluntary

N/A.

Who Pays - Fairness

The control measure is designed to cover all small MWCs (as defined in the MACT standard). This excludes very small combustors (<35Mg/day). Application of SNCR is either not technologically feasible or cost effective for these sources. Larger sources are required to meet the requirements through the MACT standard.

Location

The requirement applies to all MWCs in the five county region.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Ammonia slip emissions from the SNCR control will increase $PM_{2.5}$ emissions from the source, since the ammonia will combine with sulfate and nitrate either in the stack or ambient air to form a particulate ammonium salt. The control will also require a small amount of electricity to drive compressors and other electrical equipment which can be associated with emissions of various criteria pollutants, GHGs, and HAPs from the power generation source.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

None identified.

Secondary Costs

Consumption of reducing reagent (e.g., ammonia or urea) and the energy required to produce these chemicals.

MEASURE NO. 31
SOURCE CATEGORY Highway Vehicle and Stationary Sources
CONTROL MEASURE Prem Air Catalysts

DESCRIPTION

Prem Air catalysts, under development at Englehard Corporation, represent an approach to air pollution control that focuses on destroying pollutants already in the air, rather than controlling emission sources. When coated with heat exchange surfaces, such as vehicle radiators and air conditioning condensers, Prem Air catalysts destroy pollutants in the air that pass over these surfaces. Prem Air catalysts represent a family of technologies to provide ozone destruction for mobile and stationary applications, and CO destruction for mobile applications.

Englehard demonstrated Prem Air catalysts in stationary applications during the summer of 1995. These early tests, in which Prem Air catalysts were applied to air conditioners, heat exchangers, and air-cooled condensers, show ozone conversion rates up to 85 percent. Test sites were refineries, utilities, and industrial facilities in California, Texas, and New Jersey. Durability studies are continuing, as are other technology development efforts.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost
Operating and Maintenance Cost
Annualized Direct Costs
Administrative Costs/Issues
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels

Applicability - how many sources, their size

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

Reduces ozone, not the purcursors.

Permanence

Measurable

Demonstrations of Prem Air catalysts on passenger cars in Los Angeles showed limited effectiveness as a result of NO_x scavenging. Results may change in other urban atmospheres.

Availability

Right now, this must be considered as an emerging technology, not a demonstrated one.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

Implementation Ease

Timing of Reductions

Publicly Acceptable

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Location

SECONDARY EFFECTS
Secondary Pollutant Benefits - CO, HAPS, etc.
Secondary Benefits - materials, agricultural, tourism, land use, etc. Secondary Costs

MEASURE NO. 35
SOURCE CATEGORY Diesel Vehicles and Trucks
CONTROL MEASURE California Reformulated Diesel Fuel

DESCRIPTION

The California regulations limit motor vehicle diesel fuel sulfur content Statewide at 0.05 percent for all refiners and limit aromatic hydrocarbon content at 10 percent for large refiners and 20 percent for small refiners. The California S content limit is the same as the Federal requirement that was effective October 1, 1993. Thus, the emission benefits of California reformulated diesel would be the result of the lower aromatic hydrocarbon content of this fuel. Diesel fuel normally has about 30 percent aromatics.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost California estimated that the total capital investment by refiners in that State to meet the aromatic HC content restrictions would be $430 million for large refiners and $40 million for small refiners. Operating and Maintenance Cost Fuel price increases of 1 to 4 cents per gallon are estimated by the California Air Resources Board staff. Annualized Direct Costs Administrative Costs/Issues
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels Reduces motor vehicle diesel NO_x emissions 7 percent compared with diesel fuel meeting Federal requirements for sulfur content restrictions under Section 211 of the Clean Air Act.
Applicability - how many sources, their size All diesel-powered motor vehicles.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

0.8 tpd of NO_x reduced in 2005.

Permanence

Yes.

Measurable

Yes.

Availability

This fuel is currently being sold in California.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control. For NO_x - $3,700 to $7,700 per ton reduced.

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

Compliance would have to be determined at fueling stations.

Implementation Ease

Difficult to implement successfully in a small geographic area because long haul truckers can purchase fuel outside the nonattainment area.

Timing of Reductions

Emission reductions occur as soon as the cleaner fuel is made available for sale.

Publicly Acceptable

When reformulated diesel fuel was introduced, refiners and marketers feared that the fuel might increase engine wear because of decreased fuel lubricity. In practice, many trucks experienced leaking o-rings and seals in the fuel system. Both EPA and the California Trucking Association believed that the lower aromatic California fuel was responsible, not the lower sulfur levels. The problem was further found to be isolated to older nitrile rubber components. Once these were replaced by fluorocarbon elastomer components, or newer nitrile rubber ones, the problem seemed to disappear. It is not known whether the newer nitrile rubber components will begin to leak over time.

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Truckers will incur higher diesel fuel costs.

Location

Regulations could be written to require California reform diesel sales in the five county area. However, it would be more effective to have a larger geographic area participate in this program to ensure that trucks operating in the five county area are fueled with the lower polluting diesel.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Reduces particulate emissions by 25 percent and SO_2 emissions by 82 percent.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

PM emission reductions should lower PM ambient concentrations and improve visibility.

Secondary Costs

Trucks may have to replace seals to avoid leaks with the lower aromatic fuels.

MEASURE NO. 36
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE More Remote Sensing

DESCRIPTION

Remote sensing is a way to measure pollutant levels in a vehicle's exhaust while the vehicle is traveling down the roadway. Current RS systems measure hydrocarbons and CO in the exhaust system, and NO_x capability is being added. RS can be used to identify vehicles with malfunctioning emission controls between scheduled I/M tests. To take advantage of RSD's potential to identify dirty cars, EPA is requiring enhanced I/M programs to conduct supplemental emission measures on at least 0.5% of vehicles subject to I/M testing each year. Vehicles that fail the RS test would be required to be re-tested by the regular I/M test. Repairs would be required for any vehicle failing this out-of-schedule I/M emissions check.

Remote sensing could be used to monitor much more than 0.5% of the fleet. Pennsylvania is applying for extra credits for additional RS as part of its I/M SIP. Effectively, this means that the number of RS measurements each year in the five county area will increase from 20,000 to about 30,000.

Remote sensing could be used by I/M program areas to measure emissions from many more cars, given adequate resolution of the following issues: (1) placement of roadside monitors, (2) appropriate pass/fail levels, (3) notification, and (4) effects on driver behavior.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost
Operating and Maintenance Cost Contractor charges for performing remote sensing measurements and supplying license plate numbers and emission readings are in the range of 50 cents to one dollar per vehicle. Motorist costs for those who fail the RS test would include time for an additional inspection, plus repair costs.
Annualized Direct Costs
Administrative Costs/Issues The Commonwealth would have to process the data bases provided by the RS contractor and mail emission inspection notices to high emitters.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels

Applicability - how many sources, their size

Highway vehicles subject to emission inspections.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

1.2 tpd VOC and 0.6 tpd NO_x based on percentage reductions from the current decentralized I/M program in California.

Permanence

Measurable

There is no guidance yet from EPA on how to calculate emission credits from a remote sensing program other than the credits in MOBILE5a_H for adopting more than the minimum program.

Availability

Yes.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control: $3,340 per ton combined VOC plus NO_x.

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

There may be problems if RS readings do not correlate with Acceleration Simulation Mode test results.

Implementation Ease

Timing of Reductions

Publicly Acceptable

It is unclear how motorists will react to (1) the presence of remote sensors at the roadway measurement site and (2) to letters requesting that they bring their car in for a between cycle emission inspection.

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Location

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 37
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Scrappage Program

DESCRIPTION

On-road testing and emission models have shown that a small number of vehicles are responsible for a disproportionate amount of motor vehicle emissions. These dirty vehicles are generally older, with less sophisticated emission control equipment than recent model vehicles. One means of reducing the emissions effects of these vehicles is to remove them from service.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost Funds have to be available to purchase high-emitting vehicles for about $600 to $700 per car. Operating and Maintenance Cost Annualized Direct Costs Administrative Costs/Issues
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels Applicability - how many sources, their size

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

A limited scope program could reduce VOC and NO_x emissions by 0.1 tpd each in 2005.

Permanence

Measurable

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control: $4,800 per ton for a California program.

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

Implementation Ease

Timing of Reductions

Publicly Acceptable

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Location

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 38
SOURCE CATEGORY Heavy-Duty Diesel Vehicles
CONTROL MEASURE Emissions Inspection Program

DESCRIPTION

The Clean Air Act does not require States to implement in-use, diesel smoke testing programs. However, a number of States that exceed the Federal ambient particulate and/or NO_x standards, or for other reasons, have opted to adopt diesel testing programs. Because it is not required, EPA does not provide program design guidance, as it does for basic and enhanced I/M programs. To fill the gap, the Society of Automotive Engineers (SAE), working in conjunction with the California Air Resources Board, has stepped in to formulate a recommended testing procedure for diesel-fueled vehicles.

SAE has recently completed its protocol for diesel smoke testing (SAE J1667). The procedure uses a snap acceleration opacity test. The meter must digitally filter out the high frequency smoke readings produced during snap acceleration, and have a standardized response time. The test is repeated three times. The cut points are adjusted for dry air density and barometric pressure, although they may vary from State-to-State. Below 1,500 feet, a 40 percent opacity cut point is common for post-1991 model year engines. It is believed that these cut points are indicative of the fact that an engine is operating close to its certification level.

Concurrently, the International Standards Organization (ISO) has formed a committee to develop procedures for nonroad diesel smoke testing (ISO-8178-9). It is likely that the committee will adopt parts of SAE J1667; specifically, the smoke meter specifications and analysis procedures. The standard is expected to be completed in 1997.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost Capital costs to the Commonwealth will be minimal if existing weigh stations can be used for emission inspections. To do this, there has to be enough space to perform the emissions inspection in a lane separate from the weigh station lane. Operating and Maintenance Cost Repair costs for trucks that fail the snap idle test will average $650. In California, trucks that fail the smoke test pay a minimum penalty of $300. Annualized Direct Costs Administrative Costs/Issues Staff will have to be hired to administer the inspections.

EFFICIENCY

Control Efficiency - % reduction from uncontrolled levels

This program primarily targets PM emission reductions. Some analyses show that NO_x benefits may be 4 percent from baseline levels. However, recent data from California show potential NO_x disbenefits from the repairs made to solve excess smoke problems. California has estimated that first year benefits are a 1.1% VOC and a 1.6% PM emission reduction for diesel trucks with 8.5 percent of the fleet targeted for inspections. These benefits are estimated based on component failures, not emission measurements. If 100% of the fleet is targeted, the reduction in VOC and PM emissions is estimated to be 13% and 19%, respectively.

Applicability - how many sources, their size

Applies to heavy-duty diesel vehicles.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

Permanence

Benefits occur as long as the program is in-place.

Measurable

Because no standard protocols exist for estimating heavy-duty diesel I/M benefits, it would be necessary for the Commonwealth to reach agreement with EPA on appropriate techniques for estimating benefits.

Availability

Yes.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

IMPLEMENTABILITY

Enforcement

Enforcement effectively occurs through the inspection process.

Ease of Determining Compliance

Trucks that fail the smoke test have a defined time period to mail-in certification that repairs were made. Higher fines are paid if a truck fails the test twice within a year of the initial test.

Implementation Ease

Would require new staff and these staff would have to be trained in the test procedures. It also requires that space be available at existing weigh stations or other suitable test sites for large trucks. Urban buses can be self-inspected.

Timing of Reductions

Benefits would be observed shortly after program initiation.

Publicly Acceptable

There are currently 11 States that either have or expect to implement diesel-powered vehicle smoke I/M programs. New Jersey is currently running a pilot, roadside diesel testing program.

Politically Acceptable

Consensual

Voluntary

No.

Who Pays - Fairness

Heavy-duty diesel trucks.

Location

There are two semi-permanent weigh stations in the five county area that could be used for initial testing. One is in Delaware County at the Welcome Center on I-95. The other is at Yardley on I-95 southbound. These weigh stations are also used periodically for safety inspections.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Primary benefits are PM reductions.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Should improve visibility by reducing diesel PM.

Secondary Costs

MEASURE NO. 39
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Emissions-Based Registration Fees

DESCRIPTION

The operation of an emissions/vehicle miles traveled (VMT)-based registration fee policy requires that there be an enhanced I/M program in the area. Under the program, emission rates are measured each year, or every two years. Then, vehicle owners are charged a registration fee based on annual VMT times the vehicle emission rate. The emission rate could be VOC plus NO_x, or one of these pollutants alone.

A revenue neutral policy would be designed so that the average fee was equal to the existing Pennsylvania registration fee. This program achieves highway vehicle emission reductions by providing an incentive to retire vehicles earlier than natural scrappage would suggest, leading to a younger age mix across the vehicle fleet. This is the primary method of reducing emissions - since the program is revenue neutral, there is no change in the total driving cost, and VMT should not change.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost None Operating and Maintenance Cost If a revenue neutral program is selected, registration fees would be higher for some vehicle owners than they are now, and lower for others. Annualized Direct Costs Administrative Costs/Issues A more complex calculation of vehicle registration fees may require more Department of Motor Vehicles staff time and cost.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels

Applicability - how many sources, their size

Highway vehicles - most likely to be those included in the emission inspection program (less than 9,000 lbs).

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

Permanence

This measure's success depends on vehicle owner's responses to financial incentives to reduce emissions, so the amount of emissions that might be reduced is uncertain.

Measurable

Through analysis of enhanced I/M test results. The EPA-sponsored EFEE model can be used now to estimate emission benefits associated with different fee programs.

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

IMPLEMENTABILITY

Enforcement

Self enforcing.

Ease of Determining Compliance

Implementation Ease

Timing of Reductions

Tied to I/M program implementation scheduled.

Publicly Acceptable

Would create a different registration fee schedule in the five county area than elsewhere in Pennsylvania.

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Highest costs are likely to be borne by lower income, older car owners.

Location

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 42a
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Emissions Reduction Credit for Heavy Duty Buses: Clean Diesel for Older Buses (Baseline)

DESCRIPTION

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost 0: Assumes planned replacement program extended through 2005. New emission standards for buses will automatically reduce emissions as the fleet is replaced. It is our understanding that this element was not specifically included in the CAA baseline (MOBILE5) Operating and Maintenance Cost 0: Baseline for other SEPTA fleet measures. Annualized Direct Costs 0 Administrative Costs/Issues 0
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC: 16.8%; NO_x: 19.4% Applicability - how many sources, their size Total SEPTA diesel fleet = 1,340 vehicles; 400 planed for 1997, this scenario assumes replacement of 1,200 by 2005. Emission Reductions by Pollutant-estimated reductions - VOC only, NO_x only, VOC and NO_x combined Per Day: VOC: .47; NO_x 2.19; Combined: 2.66 Permanence Benefits will decline somewhat as fleet ages; continued maintenance can help. Other measures such as catalysts and traps can ameliorate effects.

Measurable

Vehicles should be required to be certified by EPA; on-road testing can also be done randomly to ensure continued low levels.

Availability

Engines now required to meet minimum 1994 standards (on which this is based); industry is working to improve technology.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

No incremental cost assumed.

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

On-road testing after purchase.

Implementation Ease

Standard to buy, no change in fueling, may have additional maintenance expense to ensure continued proper tuning, etc.

Timing of Reductions

Will be gradual, with scheduled replacement.

Publicly Acceptable

Still diesel-odor, etc., but improved.

Politically Acceptable

See above.

Consensual

Yes.

Voluntary

Yes.

Who Pays - Fairness

SEPTA - no incremental cost of note.

Location

SEPTA service area.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 42 b
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Emissions Reduction Credit for Heavy Duty Buses: CNG for School buses in Phil. area

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost: $21,400,000; assuming 2,000 out of 2,645 schoolbuses in Phil. area come into program (if required); slow fill stations at $102,000 each accomodating 60 vehicles each (per 1990 EPA report); incremental vehicle cost $9,000 per bus based on recent bids in California program. Amortized for 10 years at 8%; annual cost $3,189,231.
Operating and Maintenance Cost: Differential increase of $.1625 fuel cost per mile, increase of $$.1033 maintenance cost per mile, decrease of $.02 parts cost; combined increased cost per mile $.37 (averaga of 3 test cases in California per "School Bus Program- Transition to Alternative Fuels" , p. 6, by Colucci, et. al November 1995). Estimate 12,800 miles per bus per year (180 days * 71 miles- statewide average school bus miles per Pupil Transportation Office.) Annual incremental operating cost $6,293,333.
Annualized Direct Costs: $9,482,564
Administrative Costs/Issues: Refueling stations assume 1 slow fill station per 60 buses. Schools with fewer than 60 buses may need individual stations or will have to consolidate- may add costs and miles. Slow fill stations are not suitable for intermediate day runs- may also need some fast-fill capabilities for buses with longer ranges.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels
VOC- 10.7% Nox- 20.5%

Applicability - how many sources, their size: 1987 school buses total 2,645, this assumes replacement of 2000 with CNG vehicles at Cal. Air Research Board (CARB) standards.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

Per Day: VOC: -.30 NOx: -2.32 Combined: -2.62

Permanence

Benefits will decline somewhat as fleet ages; continued maintenance can help. Other measures such as catalysts and traps can ameliorate effects.

Measurable

Vehicles should be required to be certified by EPA; on-road testing can also be done randomly to ensure continued low levels.

Availability

Most experience to date in Califomia- active program including research. Capital acquisition prices have come down over the first two phases of the programs; operating costs may also declineas technology improves.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the

lifetime of the control: 2005 amortized cost per day over 2005 benefit in tons.

VOC: $290,800 N0x: $37,350 Combined: $33,200

IMPLEMENTABILITY

Enforcement: Compliance through vehicle acquisition program; need to monitor ongoing maintenance.; ensure that retired vehicles are scrapped not passed on to churches, others.

Ease of Determining Compliance

On-road testing after purchase.

Implementation Ease

Need to build fueling stations; training for fuelers and mechanics, safety procedures; determine range of vehicles vs. routes; establish incentive programs for procurements and operation; establish grounds for exemption if mandatory program.

Timing of Reductions:

As fleets are replaced.

Publicly Acceptable

Will need to advise public regarding safety concerns of fuel with their children riding. Overall bus safety a key point in CA- many other safety enhancements to buses at same time.

Politically Acceptable

See above.

Consensual:

Can wait for volunteers, with big enough incentives- assuming buses perform. May need to legislate to achieve forecast levels.

Voluntary: See above.

Who Pays - Faimess

State- Capital, School- operating- may be a problem unless operating cost differential can be reduced or eliminated- fuel efficiency, maintenance cost reductions, etc.

Location

Throughout Philadelphia ares.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

MEASURE NO. 43
SOURCE CATEGORY All Vehicles
CONTROL MEASURE Smoking Vehicle Program

DESCRIPTION

This voluntary program allows the public to report motor vehicles, trucks, and buses that are seen with excess tailpipe smoke to the State or local air pollution control agency via a toll-free number. In response, the agency sends a letter to the registered owner asking that the vehicle be voluntarily repaired, and that a questionnaire be returned to the District. By forming a partnership with the public, the program aims to educate and involve the public in an air pollution control program, and to motivate owners of gross polluting vehicles to have them fixed. It also promotes personal responsibility for cleaning the air, which mirrors the message of other outreach programs.

Smoking vehicle programs have been implemented in other nonattainment areas. For example, the San Francisco Bay Area began their program in December 1992. In the first three years of operation, this program logged over 190,000 calls from the public. Other California cities with smoking vehicle programs include Sacramento, San Diego, Los Angeles, and Ventura County.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost
Operating and Maintenance Cost In the San Francisco program, the first year publicity budget was $125,000 to reach nine counties. The budget for subsequent years is $100,000. The overall budget for the Smoking Vehicle Program in 1995-1996 was $454,700.
Annualized Direct Costs
Administrative Costs/Issues
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels The San Francisco area estimates a 0.3% reduction in VOC emissions from motor vehicles in 1994.

Applicability - how many sources, their size

Highway vehicles.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

0.2 tpd VOC

Permanence

If vehicles are repaired, the emission reductions have the same permanence that they would if an emissions inspection had prompted the repair.

Measurable

Areas have estimated emission reductions associated with smoking vehicle programs, but to date no EPA protocol exists for computing these benefits, and no area has been granted any SIP credits for their programs.

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control: $6,300 per ton of VOC.

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

Implementation Ease

Timing of Reductions

Publicly Acceptable

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Location

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Particulate emission reductions would also be achieved.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 51
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Rail Headway Improvements: Based on planned improvements to Route 7 (Bucks County)- Adding 2 trips per day peak, 18 trips per day off-peak (going to half hour headways).

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost: To be determined Operating and Maintenance Cost: To be determined Annualized Direct Costs Administrative Costs/Issues:
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC: -0.06% Nox: -0.06%
Applicability - how many sources, their size- Anticipated change in: daily passenger trips 712 peak, 3,036 off-peak; vehicle trips 475 peak, 2,024 off-peak;

VMT 6,700 peak, 28,500 off-peak.

Emission Reductions by Pollutant-estimated reductions -
VOC only: -0.042, NO_x only -0.063, VOC and NO_x combined -0.105

Permanence - Particularly important during construction, but benefits of increased riders should continue indefinitely (impacted by fares/ alternatives available/ level and quality of service)

Measurable- Changes in ridership easy to monitor; changes in emissions less direct - will depend on mode split before and after change, and mode to train station

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

VOC: $ Nox: $ Combined: $

IMPLEMENTABILITY

Enforcement- Not applicable

Ease of Determining Compliance- Not applicable

Implementation Ease: Vehicle acquisitions, additional storage for cars needed at station end, operating budget authority required.

Timing of Reductions: Concurrent with 95 construction

Publicly Acceptable- Generally, depending on impact on SEPTA budget / deficit

Politically Acceptable

See above

Consensual- Yes

Voluntary- Yes

Who Pays - Faimess

Rider and SEPTA (ultimately taxpayer for subsidized portion of trip)

Location:

Bucks County primarily- Route 7 improvements

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 70
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE: Parking Expansion at Rail Stations: Construction of planned 4,539 new parking spaces at rail stations throughout the Philadelphia region.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost: to be determined Operating and Maintenance Cost: Not determined Annualized Direct Costs: Administrative Costs/Issues:
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC- .04% Nox- .04%.
Applicability - how many sources, their size: Based on CMAQ methodology, assume 43,860 reduction in daily VMT, 3,720 increase in vehicle trips (change in mode split).

MEASURE NO. 76
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE National Low Emission Vehicle Program

DESCRIPTION

On December 9, 1994, EPA announced its final determination that reduction of new motor vehicle emissions throughout the Northeast OTR is necessary to mitigate the effects of air pollution transport, and to bring nonattainment areas in the OTR into attainment (including maintenance) of the ozone NAAQS. Through this determination, EPA promulgated a rule under Sections 184 and 110 of the Clean Air Act that requires emission reductions from new motor vehicles in the OTR to be equivalent to the reductions that would be achieved by the OTC-LEV program.

States would be relieved of their obligations under this requirement if EPA were to find that all automakers had opted into a LEV equivalent new motor vehicle control requirement deemed acceptable to EPA through rulemaking. EPA believes that such a program, which would be far better than the OTC-LEV, could be agreed upon and adopted in the near future. Because neither EPA nor the States could mandate such a program, it can become effective only upon agreement of a variety of parties.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost Auto manufacturers incur research and development expenses to improve emission control technologies. Operating and Maintenance Cost Annualized Direct Costs CARB and EPA currently estimate that vehicles meeting LEV standards will cost just below $100 more than a vehicle meeting Federal Tier 1 standards. Auto manufacturers have estimated LEV car costs to be as much as $600 or $700 per vehicle. Administrative Costs/Issues
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels Relative to the 2005 CAA baseline, the NLEV program should reduce highway vehicle emissions by 17 percent for VOC and 16 percent for NO_x.

Applicability - how many sources, their size

This program affects light-duty vehicles and light-duty trucks.

Emission Reductions by Pollutant-estimated reductions in 2005 -
VOC only, NO_x only, VOC and NO_x combined

11.5 tpd VOC, 13.5 tpd NO_x, 25 tpd VOC plus NO_x.

Permanence

Yes.

Measurable

Emission credits can be computed using MOBILE5a.

Availability

NLEV adoption is pending agreement by New York and Massachusetts to join this program. This may occur shortly after the November elections (in Massachusetts' case).

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control. The combined VOC plus NO_x cost effectiveness is $1,860 per ton.

IMPLEMENTABILITY

Enforcement

Enforcement mechanisms are expected to be the same as those used now for Federal Motor Vehicle Control Program.

Ease of Determining Compliance

EPA certifies vehicles to low emission vehicle emission standards and in-use through the recall program. State/local agencies are involved in determining in-use compliance via emissions inspection program in five county area.

Implementation Ease

Timing of Reductions

If the program begins with 1997 model year vehicles in the OTC States, benefits would begin almost immediately, but the full benefits of the NLEV program would not be observed until 2015 as vehicles that meet Federal standards are replaced by those meeting the TLEV and LEV standards.

Publicly Acceptable

Increases the price of new cars.

Politically Acceptable

Consensual

Voluntary

Who Pays - Fairness

Location

NLEV program would apply in all States except California.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Reduces CO and some hazardous air pollutants such as benzene, formaldehyde, acetaldehyde, and 1,3-butadiene.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEMORANDUM

TO: SE Pennsylvania Ozone Stakeholders

FROM: Jim Wilson, E.H. Pechan & Associates, Inc

DATE: September 27, 1996

SUBJECT: Control Measure Information

Enclosed are some more detailed control measure descriptions to augment the information that was distributed at the September 19-20, 1996 stakeholders meeting. For the most part, these are write-ups for measures that were not addressed in the "one pounder" package. I expect to receive information on travel patterns at the Philadelphia International Airport later today, and will bring this to the next meeting.

Measure 20	Gas Turbines: Oil
Measure 22	Reciprocating IC Engines
Measure 33	Driveway/Parking Lot Sealers
Measure 51	Rail Headway Improvements - Expected Improvements
Measure 51a	Rail Headway Improvements - Theoretical Improvements
Measures 61-64, 71-73	Mobility Alternatives Program
Measure 70	Parking Expansion at Rail Stations
Measure 74	Removal of 50% of Pre-1980 Vehicles
Measure 128	Expand Reform Gas Area
Measure XX	Easy Pass Program for Toll Plazas

MEASURE NO. 20
SOURCE CATEGORY Stationary Gas Turbines: Fuel Oil
CONTROL MEASURE Water Injection, SCR Plus Water Injection

DESCRIPTION

Stationary gas turbines are used for a broad scope of applications, but are most often used to generate electric power. They are available with power outputs ranging from 1 megawatt (MW) to over 200 MW.

For stationary gas turbines, NO_x reduction methodologies have been developed that utilize both combustion control and post-combustion selective catalytic reduction (SCR) techniques. Combustion control methods utilize both wet (water, steam, or water-in-oil emulsion) or dry (lean premixed and rich/quench/lean) techniques to decrease the flame temperature and therefore reduce the formation of NO_x. The post-combustion SCR technique uses an ammonia (NH_3) injection system and a catalytic reactor to chemically reduce NO_x to nitrogen gas (N_2) and water (H_2O).

Oil-fired gas turbines may choose between a water injection system or an SCR + water injection system. Reductions from these controls vary from approximately 70 percent for the water injection system to 94 percent with the additional SCR control.

Areas with NO_x emission limits for gas turbines typically exempt those used for peaking use at power facilities based on hours of utilization per year.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)

COST - All cost estimates assume 8,000 hours of operation per year.

Capital Cost

Output Power (MW)	Water Injection (millions)	SCR + Water Injection (millions)
3.3	396	622
26.3	1,320	1,770
83.3	2,470	4,600

Direct Operating and Maintenance Cost (Annual)

Output Power (MW)	Water Injection ($ thousands)	SCR + Water Injection (thousands)
3.3	68.9	127.9
26.3	514.5	378.3
83.3	1,147.3	1,009.0

Total Annual Costs

Output Power (MW)	Water Injection (thousands)	SCR + Water Injection (thousands)
3.3	143	244
26.3	754	654
83.3	1,580	1,650

Administrative Costs/Issues

EFFICIENCY

Control Efficiency - % reduction from uncontrolled levels

A control efficiency of 70 percent for the water injection system and 94 percent for the SCR + water injection system can be achieved for NO_x.

Applicability - how many sources, their size

There are 22 turbines in the five county area. Most are at PECO Energy facilities (20 units). Turbines used for cogeneration applications are at Sun Refining and Merck Sharp & Dohne (one unit each). The turbines in utility service have emissions that range from 0.01 to 0.5 tpd of NO_x. Cogeneration applications are 2.4 and 0.7 tpd.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

NO_x only. Water injection controls could reduce NO_x up to 4.6 tpd. SCR plus water injection could achieve emission reductions of as much as 6.2 tpd.

Permanence

Yes.

Measurable

Yes.

Availability

Yes.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

Output Power (MW)	Water Injection System ($/ton of NO_x)	SCR + Water ($/ton of NO_x)
3.3	1,720	8,340
26.3	1,000	2,690
83.3	672	2,430

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

Implementation Ease

Timing of Reductions

Could be achieved within 2 years of a new regulation.

Publicly Acceptable

Politically Acceptable

Consensual

Voluntary

No.

Who Pays - Fairness

Utility and industrial facilities.

Location

Regulation could be written to apply to the five county area.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

MEASURE NO. 22
SOURCE CATEGORY Stationary Reciprocating IC Engines: Natural Gas
CONTROL MEASURE SCR or NSCR

DESCRIPTION

Most stationary internal combustion engines are used to generate electric power, to pump gas or other fluids, or to compress air for pneumatic machinery. Reciprocating engines are separated into 3 design classes: 2-cycle (lean burn), 4-stroke lean burn, and 4-stroke rich burn. Each of these have design differences that affect both baseline emissions as well as the potential for emissions control.

Major NO_x sources in Pennsylvania are currently subject to control through a case-by-case RACT determination. In the five county area, major means more than 25 tons per year of NO_x emissions. Because RACT is applied case-by-case, it is not known whether any technologies have been added to the IC engines in the five county area to reduce NO_x since 1990. The most likely situation is that these units are still emitting at 1990 rates.

Modest levels of NO_x control (10-40 percent) can be achieved without adding equipment to these engines. These techniques involve air/fuel adjustment, ignition timing retard, or a combination of these two.

For IC engines, both combustion controls and post-combustion catalytic reduction have been developed. For the highest levels of control, controlled rich burn engines have mostly been equipped with non-SCR (NSCR) that uses unreacted TOCs and CO to reduce NO_x by 80 to 90 percent. NSCR is essentially the same catalytic reduction technique used in autos. Some rich burn engines can be prestratified charge engines that reduce the peak flame temperature in the NO_x forming regions. Lean burn engines have mostly met NO_x reduction requirements with lean combustion controls using torch ignition or chamber redesign to enhance flame stability. NO_x reductions of 70 to 80 percent are typical for numerous engines with retrofit or new unit controls. Lean-burn engines may also be controlled with SCR, but the operational problems associated with engine control under low NO_x operation have been a deterrent.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)

COST

Capital Cost: For NSCR applied to rich-burn SI engines, capital costs vary by size (horsepower) as shown:

Engine Size (hp)	($1,000)
80-500	15-27
501-1,000	27-41
1,001-2,500	41-87
2,501-4,000	87-132
4,001-8,000	132-253

Operating and Maintenance Cost

Annualized Direct Costs for NSCR applied to rich-burn engines by size:

Engine Size (hp)	($1,000)
80-500	69-79
501-1,000	79-90
1,001-2,500	90-124
2,501-4,000	124-158
4,001-8,000	158-244

Administrative Costs/Issues

EFFICIENCY

Control Efficiency - % reduction from uncontrolled levels

80 to 90 percent NO_x control can be achieved.

Applicability - how many sources, their size

There are 24 units in the five county area with per engine emissions ranging from 0.1 to 0.9 tpd of NO_x. Companies that would be affected by any IC engine regulations include Transcontinental Gas Pipeline, Columbia Gas Transmission, Philadelphia Gas Works, and Eastern Shore Natural Gas Company.

Emission Reductions by Pollutant-estimated reductions -
VOC only, NO_x only, VOC and NO_x combined

The CAA 2005 baseline emission estimate for this source category is 11.3 tpd of NO_x, and 0.5 tpd of VOC. An 80 percent reduction would reduce NO_x by 9 tpd.

Permanence

Yes.

Measurable

Yes.

Availability

Yes.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control. Using NSCR applied to rich burn engines, cost per ton is shown for engine size ranges.

Engine Size (hp)	$/ton of NO_x
80-500	1,260-6,900
501-1,000	750-1,260
1,001-2,500	395-750
2,501-4,000	315-395
4,001-8,000	240-315

IMPLEMENTABILITY

Enforcement

Ease of Determining Compliance

Implementation Ease

Timing of Reductions

Publicly Acceptable

Politically Acceptable

Consensual

Voluntary

No.

Who Pays - Fairness

Pipeline compressor stations.

Location

Five county area sources.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Secondary Costs

CO emissions may increase with some control techniques.

MEASURE NO. 33
SOURCE CATEGORY Asphalt Sealant
CONTROL MEASURE

DESCRIPTION

Asphalt sealants are used to restore and protect asphalt surfaces that have cured for at least 6 weeks. The South Coast Air Quality Management District (SCAQD) regulates asphalt sealants under their Architectural Coating Rules. This rule states that effective December 1, 1993, black traffic coatings must not contain more than 250 grams of VOC per liter of coating. These standards apply to manufacturers, importers and distributors who are responsible for complying with the rule. No current federal regulations concerning the VOC content of this source category exists. However, It appears that VOC content of asphalt sealants will be regulated under the proposed National Volatile Organic Compounds Emissions Standards for Architectural Coatings Rules.

The sealants manufactured for residential use consist of usually either an acrylic latex or a coal-tar/clay material. Neither product contains appreciable amounts of solvents and therefore the regulation of this product is expected to have no benefit to atmospheric VOC reductions.

The commercial version of this product category is sometimes applied hot. Current efforts are underway to determine the VOC content and emissions of these commercial products.

Criteria for Evaluating Ozone Control Measures (Revised 9/20)
COST
Capital Cost
Operating and Maintenance Cost
Annualized Direct Costs
Administrative Costs/Issues
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels

MEASURE NO. 51
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Rail Headway Improvements: Based on SEPTA's planned improvements to R 7 Rail service (Bucks County)- Adding 2 trips per day peak, 18 trips per day off-peak (going to half hour headways).

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost: $20,500,000- based on two new train sets (engine plus 6 cars per set) plus $500,000 for additional storage required at yard. Amortized for 25 years at 8%, annualized cost $1,920,400. Operating and Maintenance Cost: $4,517,000. Adds 2,443 passenger car miles per day to the system, using 6 car trains in the peak and 3 car trains in the off-peak. Cost estimate based on variable cost per mile (cost associated with vehicle miles and hours, not track); using 1993 reported SEPTA cost per passenger car mile, assuming one-half of operating expense is variable with miles (per national averages). Annualized Direct Costs: $6,437,400 based on above. Administrative Costs/Issues: None assumed.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC: -0.06% Nox: -0.06%
Applicability - how many sources, their size- Anticipated change in: daily passenger trips 712 peak, 3,036 off-peak;

vehicle trips 475 peak, 2,024 off-peak;

VMT 6,700 peak, 28,500 off-peak.

Emission Reductions by Pollutant-estimated reductions -
VOC only: -0.042, NO_x only -0.063, VOC and NO_x combined -0.105

Permanence - Particularly important during construction, but benefits of increased riders should continue indefinitely (impacted by fares/ alternatives available/ level and quality of service)

Measurable- Changes in ridership easy to monitor; changes in emissions less direct - will depend on mode split before and after change, and mode to train station

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

VOC: $510,900 Nox: $340,600 Combined: $204,400

IMPLEMENTABILITY

Enforcement- Not applicable

Ease of Determining Compliance- Not applicable

Implementation Ease: Vehicle acquisitions, additional storage for cars needed at station end, operating budget authority required.

Timing of Reductions: Concurrent with 95 construction

Publicly Acceptable- Generally, depending on impact on SEPTA budget / deficit

Politically Acceptable

See above

Consensual- Yes

Voluntary- Yes

Who Pays - Fairness

Rider and SEPTA (ultimately taxpayer for subsidized portion of trip)

Federal government typically provides major portion of most capital funding (new train acquisition)

Location:

Bucks County primarily- R 7 improvements

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Reduced roadway congestion, reduced fuel use

Secondary Costs

MEASURE NO. 51
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE Rail Headway Improvements: Based on SEPTA's planned improvements to R 7 Rail service (Bucks County)- Adding 2 trips per day peak, 18 trips per day off-peak (going to half hour headways).

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost: $20,500,000- based on two new train sets (engine plus 6 cars per set) plus $500,000 for additional storage required at yard. Amortized for 25 years at 8%, annualized cost $1,920,400. Operating and Maintenance Cost: $4,517,000. Adds 2,443 passenger car miles per day to the system, using 6 car trains in the peak and 3 car trains in the off-peak. Cost estimate based on variable cost per mile (cost associated with vehicle miles and hours, not track); using 1993 reported SEPTA cost per passenger car mile, assuming one-half of operating expense is variable with miles (per national averages). Annualized Direct Costs: $6,437,400 based on above. Administrative Costs/Issues: None assumed.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC: -0.06% Nox: -0.06%
Applicability - how many sources, their size- Anticipated change in: daily passenger trips 712 peak, 3,036 off-peak;

vehicle trips 475 peak, 2,024 off-peak;

VMT 6,700 peak, 28,500 off-peak.

Emission Reductions by Pollutant-estimated reductions -
VOC only: -0.042, NO_x only -0.063, VOC and NO_x combined -0.105

Permanence - Particularly important during construction, but benefits of increased riders should continue indefinitely (impacted by fares/ alternatives available/ level and quality of service)

Measurable- Changes in ridership easy to monitor; changes in emissions less direct - will depend on mode split before and after change, and mode to train station

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

VOC: $510,900 Nox: $340,600 Combined: $204,400

IMPLEMENTABILITY

Enforcement- Not applicable

Ease of Determining Compliance- Not applicable

Implementation Ease: Vehicle acquisitions, additional storage for cars needed at station end, operating budget authority required.

Timing of Reductions: Concurrent with 95 construction

Publicly Acceptable- Generally, depending on impact on SEPTA budget / deficit

Politically Acceptable

See above

Consensual- Yes

Voluntary- Yes

Who Pays - Fairness

Rider and SEPTA (ultimately taxpayer for subsidized portion of trip)

Federal government typically provides major portion of most capital funding (new train acquisition)

Location:

Bucks County primarily- R 7 improvements

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Reduced roadway congestion, reduced fuel use

Secondary Costs

MEASURE NO. 51a (NEW).
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE **Rail Headway Improvements: Academic Exercise**
Analysis: Adding 2 peak trains to selected lines with high ridership, decreasing the headways during the peak from 30 minutes to 15 minutes (less on some lines). Specifically add peak service to Wilmington, Airport, Norristown, Warminster, Elwyn.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital Cost: $102,500,000 based on 10 new train sets (engine plus 6 cars per set) plus $500,000 for additional storage required at each yard. Amortized for 25 years at 8%, annualized cost $9,602,000. Note that actual procurements would probably be for multiple unit cars (MUs) that can be split into 2 or 3 car units for greater operating flexibility. This would increase the capital cost. Likewise, if the fleet were to expand by 60 vehicles, a new maintenance and/or operating facility would likely be required, as current facilities are at capacity. Operating and Maintenance Cost: $15,072,208. Adds 2,325,600 passenger car miles per year to the system, using 6 car trains in the peak. Cost estimate based on variable cost per mile (cost associated with vehicle miles and hours, not track); using 1993 reported SEPTA cost per passenger car mile, assuming one-half of operating expense is variable with miles (per national averages). Annualized Direct Costs: $ 24,674,300 based on above. Administrative Costs/Issues: None assumed.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC: -1.8 % Nox: - 1.4%
Applicability - how many sources, their size- Anticipated change in: daily passenger trips - 12,840

vehicle trips - 8,560

VMT - 101,600

Emission Reductions by Pollutant-estimated reductions - tons per day
VOC only: -.12, NO_x only -.15, VOC and NO_x combined -.27

Permanence - Benefits of increased riders should
continue indefinitely (impacted by fares/ alternatives available/ level and quality of service)

Measurable- Changes in ridership easy to monitor; changes in emissions less direct - will depend on mode split before and after change, and mode to train station

Availability

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

VOC: $691,700 Nox: $549,400 Combined: $306,200

IMPLEMENTABILITY

Enforcement- Not applicable

Ease of Determining Compliance- Not applicable

Implementation Ease: Vehicle acquisitions, additional storage for cars needed at station end, operating budget authority required. Very unlikely to implement due to operating budget constraints.

Timing of Reductions: Unlikely

Publicly Acceptable- Generally, depending on impact on SEPTA budget / deficit

Politically Acceptable

See above

Consensual- Yes

Voluntary- Yes

Who Pays - Fairness

Rider and SEPTA (ultimately taxpayer for subsidized portion of trip)

Federal government typically provides major portion of most capital funding (new train acquisition)

Location:

Bucks, Delaware and Montgomery Counties (rail lines to Wilmington, airport, Warminster, Norristown and Elwyn)

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Reduced congestion on roadways, reduced fuel use

Secondary Costs

MEASURE NO. 61, 62, 63, 64, 71, 72, and 73
SOURCE CATEGORY Highway Vehicles
CONTROL MEASURE: Mobility Alternatives Program: Comprehensive program to promote rideshare, telecommute, transit pass, bicycle alternatives, etc.

Criteria for Evaluating Ozone Control Measures (Revised 6/20)
COST
Capital: 0 Operating and Maintenance: $807,000 - annual budget for 1997. Does not include savings in time, vehicle depreciation, or fuel that will accrue from reduced congestion and reduced vehicle trips. Annualized Direct Costs: $807,000 Administrative Costs/Issues: None assumed.
EFFICIENCY
Control Efficiency - % reduction from uncontrolled levels VOC: -1.2 % Nox: - 0.9 %
Applicability - how many sources, their size- Anticipated change in:

vehicle trips 6,000 (remove 3,000 vehicles from road per MAP report of progress)

VMT reduction of 64,100 miles per day

Emission Reductions by Pollutant-estimated reductions -
VOC only: -0.082, NO_x only -0.096, VOC and NO_x combined - 0.178

Permanence - Likely to continue and expand as long as support program continues.

Measurable- Difficult- voluntary compliance form employers. Reporting also voluntary- results may be understated.

Availability- regionwide.

COST-EFFECTIVENESS - cost/ton for each precursor and for both precursors combined, over the lifetime of the control

VOC: $10,609,800 Nox: $9,062,500 Combined: $4,887,600

IMPLEMENTABILITY

Enforcement- Not applicable

Ease of Determining Compliance- Not applicable

Implementation Ease: Already in place. Voluntary program.

Timing of Reductions: Phased with marketing and expansion of program.

Publicly Acceptable- Highly acceptable.

Politically Acceptable

See above

Consensual- Yes

Voluntary- Yes

Who Pays - Fairness

Ultimately taxpayer, funded through multiple organizations, benefits accrue regionwide

Location:

Regionwide.

SECONDARY EFFECTS

Secondary Pollutant Benefits - CO, HAPS, etc.

Secondary Benefits - materials, agricultural, tourism, land use, etc.

Reduced congestion on roadways, reduced fuel use

Secondary Costs